United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Southwest Region
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Sacramento, California 95825-1846

In Reply Refer To:
08FBDT00-2016-F-0247

JUN 2 3 2017

Memorandum

To: Regional Director, U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, California

From: Regional Director, U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California

Subject: Biological Opinion for the California WaterFix

This memorandum is in response to the U.S. Bureau of Reclamation's (Reclamation) July 29, 2016 letter requesting consultation with the U.S. Fish and Wildlife Service (Service) on the effects of the California WaterFix (CWF) on species listed and critical habitat designated under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*; [Act]). Reclamation was designated as lead action agency and the U.S. Army Corps of Engineers is an additional Federal action agency for this consultation.

A *Biological Assessment for the California WaterFix* (BA), dated July 2016, accompanied the request. In a memorandum dated September 15, 2016 to Reclamation, the Service agreed that formal consultation could be initiated. An Administrative Draft Biological Opinion (BiOp) was provided to the action agencies and applicant on January 19, 2017. The attached Final BiOp incorporates relevant information provided by the action agencies and applicant, including comments, changes, and additions to the CWF provided since consultation was initiated.

The Service has prepared a mixed programmatic BiOp on the CWF. This BiOp represents the culmination of consultation on a mix of standard-level and programmatic-level project elements. An analysis and conclusion of whether or not the entire CWF action is likely to jeopardize each listed species or destroy or adversely modify designated critical habitat is included in this BiOp. All activities addressed programmatically will be subject to a subsequent consultation on future Federal actions in order to proceed.

The following activities analyzed as a standard consultation are: (1) construction of the tunnels; (2) expansions and other modifications of Clifton Court Forebay; (3) associated infrastructure; (4) geotechnical explorations, (5) compensatory mitigation associated with construction except the North Delta Diversions (NDD), Head of Old River Gate (HORG), and Contra Costa Water District (CCWD) settlement agreement facilities; and (6) specific construction-related conservation measures including preconstruction surveys for listed terrestrial species.

Where incidental take of threatened or endangered species is reasonably certain to occur, an Incidental Take Statement for these activities is included with this BiOp.

The following activities requiring future Federal approvals and therefore addressed programmatically are: (1) construction of the NDD and associated structures; (2) construction of the HORG; (3) construction of the CCWD settlement agreement facilities; (4) operations of new and existing CVP and SWP water facilities under dual conveyance; (5) future maintenance; (5) future monitoring; (6) compensatory mitigation associated with construction of the NDD, HORG, and CCWD settlement agreement facilities; and (7) the CWF Adaptive Management Program. In order to ensure that future actions developed for the CWF are consistent with this analysis, Reclamation and DWR have proposed a framework consisting of Guiding Principles that are analyzed as part of this BiOp. One or more subsequent consultations will be needed to address activities associated with future approvals. No Incidental Take Statement is included for activities addressed programmatically because those subsequent consultations will address incidental take associated with those activities.

The Service has analyzed the operational scenario for CWF included in the BA. The agencies recognize this operational scenario will change between now and the time that the CWF facilities are operational. Changes to the operational scenario will be analyzed in subsequent consultation.

The attached BiOp addresses effects of the CWF to 16 federally-listed species and designated critical habitat. Appendix A of the BiOp includes justifications for the species and critical habitat that were determined not likely to be adversely affected. Effects to the remainder of the species and critical habitat are addressed in the BiOp. The Service has determined that the CWF is not likely to jeopardize the continued existence of any of these species, and is not likely to destroy or adversely modify designated critical habitat.

The Service appreciates Reclamation's efforts to complete this consultation. We look forward to further coordination on the CWF. If you have any questions on this consultation, please contact Kaylee Allen, Field Supervisor, San Francisco Bay-Delta Fish and Wildlife Office at kaylee_allen@fws.gov or (916) 930-5603.

Attachment

cc: Barry Thom, National Marine Fisheries Service, Portland, OR
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BIOLOGICAL OPINION
For the California WaterFix

Service File No. 08FBDT00-2016-F-0247

U.S. Fish and Wildlife Service
San Francisco Bay-Delta Fish and Wildlife Office
Sacramento, California

Signed: June 23, 2017

Regional Director, Pacific Southwest

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LIST OF ACRONYMS

Act	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et* seq.)
af	acre feet
AFRP	Anadromous Fish Restoration Program
AG	agricultural
AMM	Avoidance and Minimization Measure
AMP	Adaptive Management Program
AN	above normal
BA	Biological Assessment
BCDC	Bay Conservation and Development Commission
BDFWO	San Francisco Bay-Delta Fish and Wildlife Office
BiOp	Biological Opinion
BMP	Best Management Practice
BN	below normal
C	critical
CCF	Clifton Court Forebay
CCPP	Clifton Court Pumping Plant
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHNSR	spring-run Chinook salmon
CHNWR	winter-run Chinook salmon
CIDH	cast-in-drilled-hole
CNDDB	California Natural Diversity Database
CNOR	Candidate Notice of Review
COA	Coordinated Operation Agreement
Corps	U.S. Army Corps of Engineers
CSAMP	Collaborative Science and Adaptive Management Program
CVFPB	Central Valley Flood Protection Board
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVRWQCB	Central Valley Regional Water Quality Control Board
CVTRT	Central Valley Technical Recovery Team
CWF	California WaterFix
cy	cubic yards
dB	decibel
dBA	A-weighted decibel
D	dry
DCC	Delta Cross Channel
DEIR	Draft Environmental Impact Report
DEIS	Draft Environmental Impact Statement
DHCCP	Delta Habitat and Conservation Conveyance Program
DJFMP	Delta Juvenile Fish Monitoring Program

DOI	Department of the Interior
DRERIP	Delta Regional Ecosystem Restoration Implementation Plan
DSM2	Delta Simulation Model II
DSOD	Division of Safety of Dams
DSP	Delta Science Program
DWR	Department of Water Resources
E/I	[Delta] export/inflow
EC	electrical conductivity
ECOS	Environmental Conservation Online System
EDSM	Enhanced Delta Smelt Monitoring
ELT	Early Long-Term
EPA	Environmental Protection Agency
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
FCCL	Fish Conservation and Culture Laboratory
FL	fork length
FFTT	Fish Facilities Technical Team
FFWT	Fish Facilities Working Team
FMWT	Fall Midwater Trawl
ft	feet or foot
FR	Federal Register
H	horizontal
ha	hectares
HCP	habitat conservation plan
HOR	Head of Old River
HORG	Head of Old River Gate
I/E	[San Joaquin River] inflow/export
IEP	Interagency Ecological Program
IF	Intermediate Forebay
IICG	Interagency Implementation and Coordination Group
ITP	Incidental Take Permit
ITS	Incidental Take Statement
kV	kilovolt
LFWO	Lodi Fish and Wildlife Office
LSNFH	Livingston Stone National Fish Hatchery
LSZ	low-salinity zone
m	meter
MIDS	Morrow Island Distribution System
MHHW	Mean High High Water
MLLW	Mean Low Low Water
MI	municipal and industrial
mg/L	milligrams per liter
mm	millimeter
m^3/s	cubic meters per second

NAA	No Action Alternative
NCCF	North Clifton Court Forebay
NCCP	Natural Community Conservation Planning
NDD	North Delta Diversions
NDDTT	North Delta Diversion Technical Team
NDOI	Net Delta Outflow Index
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
No.	number
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
OMR	Old and Middle river
PA	Proposed Action
PCE	Primary Constituent Elements
PG&E	Pacific Gas and Electric
PP	pumping plant
ppt	parts per thousand
Reclamation	U.S. Bureau of Reclamation
RI	River Index
RIT	Recovery Implementation Team
RM	river mile
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative
RRDS	Roaring River Distribution System
RTM	Reusable Tunnel Material
RTO	real-time operations
SBFNC	Suisun Bay Federal Navigation Channels
SCCF	South Clifton Court Forebay
SDWSC	Stockton Deep Water Ship Channel
Secretary	Secretary of the Interior
SEL	sound exposure level
SERP	Small Erosion Repair Program
Service	U.S. Fish and Wildlife Service
SKT	Spring Kodiak Trawl
SLC	California State Lands Commission
SMSCG	Suisun Marsh Salinity Control Gates
SMUD	Sacramento Municipal Utility District
SPL	sound pressure level
sq	square feet
SR	State Route
SRDWSC	Sacramento River Deep Water Ship Channel
SRWTP	Sacramento Regional Wastewater Treatment Plant
Strategy	Delta Smelt Resiliency Strategy
SWP	State Water Project

SWPPP	Stormwater Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TAF	thousand acre feet
TBM	Tunnel Boring Machine
TNS	[Summer] Townet Survey
TOT	Technical Oversight Team
U.S.	United States
U.S.C.	United States Code
V	vertical
W	wet
Western	Western Area Power Administration
WREM	Water Resources Engineering Memorandum
WQCP	Water Quality Control Plan
WSE	Water Surface Elevation
WY	water year

1.0 INTRODUCTION

The California Department of Water Resources (DWR) proposes to: (1) construct, operate, and maintain new water conveyance facilities in the Sacramento–San Joaquin Delta, including three intakes, two tunnels, associated facilities, and a permanent Head of Old River Gate (HORG), (2) operate existing State Water Project (SWP) Delta facilities in coordination with the new facilities, (3) maintain the newly-constructed and existing facilities, (4) implement and uphold new and existing conservation measures, and (5) implement and assist in an ongoing monitoring and a new adaptive management program.

The United States (U.S.) Department of the Interior (DOI), Bureau of Reclamation (Reclamation), as the Federal lead agency for the Endangered Species Act (Act) section 7 consultation [acknowledging the U.S. Army Corps of Engineers (Corps) as an additional Federal action agency], proposes to coordinate Central Valley Project (CVP) operations with DWR, the applicant, using the new and existing facilities. The Corps proposes to issue permits to DWR pursuant to Rivers and Harbors Act Section 10, Clean Water Act Section 404, and 33 United States Code (U.S.C.) 408.

DWR is the entity undertaking all construction-related activities including those related to the intakes, the associated tunnels, and their associated structures. When referring to DWR throughout this BiOp as the entity carrying out construction, operation, or maintenance of the CWF, it includes DWR's agents and those under DWR's supervision (6/13/2017 email from Kenneth Bogdan, DWR). The in-water construction activities associated with the intakes, tunnels, and associated structures, as well as the change in SWP Delta operations, requires a combination of Rivers and Harbors Act Section 10, Clean Water Act Section 404, and 33 U.S.C. 408 approvals from the Corps. DWR and/or its designees will operate and maintain the facilities, and Reclamation will adjust its operation of the CVP to utilize the dual water conveyance system.

DWR's operation of the proposed facilities, referred to as "California WaterFix," would modify operation of SWP, which is operated in coordination with the CVP. Reclamation is responsible for operation and maintenance of the CVP and DWR is responsible for the operation and maintenance of the SWP. The proposed new facilities would operate in coordination with the existing Delta facilities, including the Clifton Court Forebay (CCF), located in San Joaquin County, California. The three proposed intakes, comprising the new proposed North Delta Diversions (NDD), would be located on the east bank of the Sacramento River near Clarksburg, in Sacramento County, California, and connected to the CCF by two underground tunnels and a new pumping plant, which would be sited at an expanded CCF. The proposed new facilities would provide water for intake at the Banks Pumping Station and the South Bay Pumping Plant, which are existing SWP facilities that draw water from the CCF for distribution through existing SWP facilities.

2.0 PURPOSE OF THIS CONSULTATION

The Service concurs with Reclamation's likely to adversely affect determinations. Therefore, this consultation examines whether the California WaterFix (CWF) Proposed Action (PA) is likely to jeopardize the continued existence of the threatened California red-legged frog (*Rana draytonii*), threatened California tiger salamander (Central California Distinct Population Segment; *Ambystoma californiense*), threatened delta smelt (*Hypomesus transpacificus*), threatened giant garter snake (*Thamnophis gigas*), endangered Least bell's vireo (*Vireo bellii pusillus*), endangered San Joaquin kit fox (*Vulpes macrotis mutica*), threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), threatened vernal pool fairy shrimp (*Branchinecta lynchi*), endangered vernal pool tadpole shrimp (*Lepidurus packardi*), and threatened western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). Additionally, this consultation addresses whether the CWF PA is likely to destroy or adversely modify delta smelt critical habitat.

3.0 SPECIES' AND CRITICAL HABITAT NOT LIKELY TO BE ADVERSELY AFFECTED

The Service concurs with Reclamation's determination that the PA may affect, but is not likely to adversely affect the endangered California clapper rail (*Rallus longirostris obsoletus*), endangered California least tern (*Sternula antillarum browni*), California red-legged frog designated critical habitat, endangered riparian brush rabbit (*Sylvilagus bachmani riparius*), endangered salt marsh harvest mouse (*Sternula antillarum browni*), endangered soft bird's-beak (*Cordylanthus mollis ssp. mollis*), and endangered Suisun thistle (*Cirsium hydrophilium*). While critical habitat is designated within the action area for the soft bird's-beak and Suisun thistle, the critical habitat is not likely to be adversely affected by the PA and will not be addressed further. Reclamation determined that critical habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp was likely to be adversely affected. However, upon review, the Service has determined that critical habitat for both species is not likely to be adversely affected. The avoidance and minimization measures (AMMs) identified in the *Description of the Proposed Action* support these not likely to adversely affect species' and critical habitat determinations. Refer to *Appendix A* for further justifications related to these determinations.

Recent genetic analyses of rail species resulted in a change in the common name and taxonomy of the large, "clapper-type" rails (*Rallus longirostris*) of the west coast of North America to Ridgway's rail (*Rallus obsoletus*) (Maley and Brumfield 2013; Chesser *et al.* 2014). Thus, the California clapper rail (*Rallus longirostris obsoletus*) is now referred to in the scientific community as the California Ridgway's rail (*Rallus obsoletus obsoletus*). The change in the common name and taxonomy of the California clapper rail does not change the listing status of the species under the Act and is referred to by the original name in this biological opinion (BiOp).

4.0 CONSULTATION HISTORY

This consultation is the most recent in a long history of activities regarding the CVP and SWP operations. A detailed discussion of the history leading up to this consultation can be found in the Service's 2005 *Reinitiation of Formal and Early Section 7 Endangered Species Consultation on the Coordinated Operations of the Central Valley Project and State Water Project and the Operational Criteria and Plan to Address Potential Critical Habitat Issues* and 2008 *Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP)*. Additional information on the consultation history can be found in Chapter 2 of the July 2016 *Biological Assessment for the California WaterFix* (BA) that documents the technical assistance provided by the Service during the development of the CWF BA.

July, 2006	Several State and private parties enter into a memorandum of agreement (MOA) that sets out the financial commitments of the parties to carry out actions to satisfy existing regulatory requirements related to operation of the CVP and SWP and develop a habitat conservation plan (HCP) for the Delta that would support new regulatory authorizations under State and Federal endangered species laws for current and future activities related to the CVP and SWP. This plan comes to be called the Bay Delta Conservation Plan (BDCP). DWR unites the MOA parties into a BDCP Steering Committee, which commences regular meetings that continue until November 18, 2010.
December 15, 2008	The Service issues a BiOp for the *Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP)* (Service 2008), portions of which address operation and management of CVP and SWP facilities in the Delta. Reclamation provisionally accepts and then implements the BiOp including the Reasonable and Prudent Alternative (RPA).
June 4, 2009	NMFS issues a BiOp for the *Long-Term Operations of the Central Valley Project and State Water Project* (NMFS 2009), portions of which address operation and management of CVP and SWP facilities in the Delta. Reclamation provisionally accepts the BiOp, including the RPA, on June 4, 2009, and then implements the BiOp including the RPA.
September, 2010	The Service issues a BiOp, analyzing the effects of proposed geotechnical explorations to inform the BDCP and preliminary engineering studies for the Delta Habitat Conservation and Conveyance Program (DHCCP).
December, 2010	The BDCP steering committee is dissolved and DWR continues the BDCP planning process as the principal applicant for the BDCP, which is intended to serve as an HCP for the purposes of compliance with the Act

	and as a natural community conservation plan (NCCP) for the purposes of Natural Community Conservation Planning Act (NCCPA) compliance. The BDCP at this stage includes, in a preliminary form, the proposed new facilities and water operations subsequently incorporated into the PA for the CWF. DWR and its contractors meet regularly with Reclamation, CDFW, NMFS, and Service staff members to discuss issues related to development of the HCP and NCCP; these meetings continue until release of the draft BDCP in December 2013.
April 7, 2011	NMFS issues amendments to the RPA of its 2009 BiOp (NMFS 2009). Subsequent references in this BiOp to the 2009 NMFS BiOp should be interpreted to include reference to these 2011 amendments, as applicable.
July 15, 2011	The Service participates in a 5-agency effort to provide recommendations to agency management on the intake location, size, design, and configuration in the north Delta. After a series of meetings, the Fish Facilities Technical Team (FFTT) produces a Technical Memorandum on July 15, 2011. The Technical Memorandum includes in the appendix the previous August 2008 recommendations from the FFTT.
July 28, 2013	As a follow-up to the July 15, 2011 FFTT Technical Memorandum, the Service participates in a series of meetings to develop a Work Plan which focuses on initial scope, schedule, and cost estimates for the 22 technical studies identified in the Technical Memorandum related to the NDD.
December 13, 2013-July 29, 2014	DWR issues draft BDCP, files an application for an Incidental Take Permit (ITP) under section 10 of the Act, and together with Reclamation, NMFS, and Service, issues a Draft Environmental Impact Report/Draft Environmental Impact Statement (DEIR/DEIS), evaluating the BDCP and 12 other alternatives. Public comment period on the plan and EIR/EIS extends through July 29, 2014.
January 9, 2015	Reclamation reinitiates consultation with the Service on the 2008 Service BiOp and Conveyance of Revised Incidental Take for the 2015 Water Year (WY).
February, 2015	Reclamation and DWR decide to pursue a section 7 consultation instead of a HCP as a pathway for incidental take authorization for the construction and operation of the water facilities formerly proposed under BDCP.
March 25, 2015 - July 19, 2016	The Service and CDFW participate in the Terrestrial Technical Team (TTT) with Reclamation, Corps, DWR, and ICF International, which consisted of conference calls and in-person meetings up to

	multiple times per week as necessary to discuss species lists, species and critical habitat determinations, avoidance and minimization measures, conservation measures, and effects to State and federally listed terrestrial species and their critical habitats. The Service reviews and comments numerous iterations of biological assessment components as part of the TTT.
April 2, 2015	The Corps Sacramento District designates Reclamation as lead Federal agency for the section 7 consultation on the CWF.
June 30, 2015 - June 30, 2016	The BDCP/CWF Partially Recirculated DEIR/Supplemental DEIS is made available for public review and comment.
October 1, 2015	Reclamation transmits a draft CWF BA to the Service and NMFS for review.
October 30, 2015	Reclamation transmits additional components of the draft CWF BA to the Service and NMFS for review.
November 2015	The Service and NMFS provide comments on the draft CWF BA to Reclamation in the context of a series of meetings and emails.
April 5-6, 2016	The Delta Science Program (DSP) conducts a 2-day meeting related to an independent scientific evaluation of the methods and approaches for developing the biological assessments for the section 7 consultations and analyses prepared for the CDFW 2081 (b) ITP application for the CWF.
May 12, 2016	The Service receives the final report *Independent Review Panel Report for the 2016 California WaterFix Aquatic Science Peer Review* of the Phase 1 independent science review. The final report is available at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/BDCP/ca_waterfix_aq_sci_review_report_final_may12.pdf
July 26, 2016	The Service receives a letter from Natural Resources Defense Council (NRDC), which includes scientific information relevant to the consultation.
July 29, 2016	The Service receives electronic copy of Reclamation's initiation letter requesting consultation with the Service on the effects of the CWF accompanied by a biological assessment titled *Biological Assessment for the California WaterFix*, dated July 2016.
August 2, 2016	The Service receives a letter from Reclamation and DWR requesting to initiate reinitiation of consultation on the 2008 Service BiOp. The

	reinitiation was based on new information related to multiple years of drought and recent data demonstrating a low delta smelt population and new information available and expected to become available as a result of the ongoing work through collaborative science processes.
August 3, 2016	The Service sends a response to Reclamation and DWR acknowledging the receipt of the August 2, 2017 reinitiation request. The letter acknowledged that a Consultation Agreement would be developed by the fall outlining the tasks, process and schedule to complete a BA and BiOp.
September - December 13, 2016	The Service, NMFS, and CDFW participate in conference calls, email exchanges, and in-person meetings with DWR, Reclamation, Corps, and consultants to provide comments and receive responses on additional information requests resulting in the *BiOp Resolution Log*.
September 23, 2016	The Service receives a memorandum from ICF International which includes clarifications to comments and questions on the CWF BA. The memo addresses the following species: San Joaquin kit fox, giant garter snake, California red-legged frog, California tiger salamander, and valley elderberry longhorn beetle.
November 4, 2016	The Service and NMFS receive an email transmittal from Reclamation adding the Contra Costa Water District Settlement Agreement actions to the CWF project description.
November 7, 2016	The Service and NMFS receive an email transmittal from Reclamation adding restoration timing commitments and revisions of spring outflow criteria to the CWF project description.
November 29, 2016	The Service receives a memo from Reclamation with the subject: *California WaterFix (CWF): Endangered Species Act (ESA) Section 7 Consultation – Scope of Current and Future Federal Actions*.
December 13, 2016	The Service and NMFS receive the *BiOp Resolution Log*, which documents comments and responses between the Service, NMFS, CDFW, DWR, Reclamation, Corps, and consultants.
December 23, 2016	The Service transmits the Draft Partial CWF BiOp to the Delta Stewardship Council for independent peer review. NMFS posts online at http://www.westcoast.fisheries.noaa.gov/central_valley/WaterFix/WaterFixPeerReview2BMaterials.html.
December 23, 2016- January 19, 2017	The Service, NMFS, CDFW participate in conference calls, emails, and in person meetings with DWR, Reclamation, Corps, and consultants

	regarding partial draft BiOps.
January 19, 2017	The Service transmits the administrative draft of the CWF BiOp to Reclamation with copies to the Corps, NMFS, and CDFW.
January 19, 2017	The Service and NMFS received an email from Reclamation describing commitments related to long-term operations of the CWF.
January 19-May 12, 2017	The Service, NMFS, CDFW participate in conference calls, emails, and in person meetings with DWR, Reclamation, Corps, public water agencies, and consultants to resolve comments received on the Service's administrative draft of the CWF BiOp.
January 23-24, 2017	The Delta Science Program (DSP) conducts a 2-day meeting related to an independent scientific evaluation of the methods and analyses in the draft aquatic sections of the BiOps.
January 26, 2017	The Service receives Reclamation's comments on the December 23, 2016 Draft Partial CWF BiOp via email.
February 21-22, 2017	The Service receives Reclamation and DWR's comments on the January 19, 2017 administrative draft of the CWF BiOp.
February 24, 2017	The Service receives a letter from NRDC, Defenders of Wildlife, and the Bay Institute outlining concerns about the draft CWF BiOp.
March 8, 2017	The Service receives final reports for the *Independent Review Panel Report for the 2016-2017 California WaterFix Aquatic Science Peer Review Phase 2A* and *Independent Review Panel Report for the 2016-2017 California WaterFix Aquatic Science Peer Review Phase 2B* from the DSP. As appropriate, the recommendations from the independent peer review panel's final reports were addressed and incorporated into this BiOp. The Phase 2A final report is available at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/CAWaterFix/Peer%20Review%202A/ca.waterfix.phase2a.version2017mar07_final_to_dsp.pdf. The Phase 2B final report is available at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/CAWaterFix/Peer%20Review%202B/ca.waterfix.phase2b.version2017mar07_final_to_dsp.pdf
May 5, 2017	The Service receives from DWR revisions to the project description including Guiding Principles for CWF actions and subsequent consultations, changes to operations of the NDD and pulse flow protections for salmonids, changes to south Delta operations in October

	and November, and changes to delta smelt compensatory mitigation along with a new long-term sensitivity analysis simulation of the PA which included some of the changes.
May 19, 2017	The Service receives a request from Kern County Water Agency, San Luis & Delta-Mendota Water Authority, Santa Clara Valley Water District and Westlands Water District requesting to review Draft CWF BiOp.
May 23, 2017	The Service provides the Draft CWF BiOp to representatives from Kern County Water Agency, San Luis & Delta-Mendota Water Authority, Santa Clara Valley Water District, Westlands Water District and Metropolitan Water District.
May 24, 2017	The Service receives from Reclamation and DWR modifications to the project description, *BiOp Resolution Log, Adaptive Management Framework* and funding assurances.
May 26, 2017	The Service meets with DWR to receive additional comments on the Draft CWF BiOp.
May 26, 2017	The Service receives joint written comments from Kern County Water Agency, San Luis & Delta-Mendota Water Authority, Santa Clara Valley Water District and Westlands Water District.
May 26, 2017	The Service receives written comments from Grasslands Water District concerning the possibility of reduced allocation to CVP contractors, including south-of-Delta wildlife refuges, which receive CVP water on a priority basis and provide wetland habitat for a number of threatened and endangered species, and that any reduced south Delta diversions would require further mitigation to ensure no harm to critical refuge water deliveries.
May 30, 2017	The Service receives an email from DWR with written clarifications to the longfin spring outflow criteria.
June 6, 2017	The Service receives written comments from Kern County Water Agency.
June 7, 2017	The Service receives an email from NRDC which includes scientific information and analysis related to abundance and survival of delta smelt.

5.0 CONSULTATION APPROACH

The purpose of this section 7 consultation is to evaluate the effects of the CWF on listed species and designated critical habitat. After reviewing the CWF as proposed by Reclamation and the Corps and the Corps' permitting schedule, the Service has determined that CWF presents a mixed programmatic action, as defined in 50 CFR 402.02. The Service's consultation includes a mix of standard consultation (which includes an Incidental Take Statement [ITS]) and programmatic consultation (which can include an ITS or defer the ITS to a later time associated with subsequent Federal actions). An analysis and conclusion of whether or not the entire CWF action as described in the PA is likely to jeopardize listed species or destroy or adversely modify critical habitat is included in this BiOp. All activities addressed programmatically will be subject to a subsequent consultation in order to proceed. Additionally, some project elements and their effects on listed species or critical habitat will change as DWR continues to develop the PA and may require reinitiation.

Some of the project elements are described at a site-specific level for near-term implementation with no future Federal action required. For other project elements, the PA provides a framework for the development of future Federal actions that will be authorized, funded, or carried out at a later time. This BiOp uses a programmatic approach to evaluate the elements of the PA that will be subject to future project-specific consultations because of subsequent Federal approvals. Table 5.0-1 describes the approach we took for each project element. In addition, a schematic explaining this approach and phase maps are included in Appendix C. The analysis in this BiOp allows for a broad-scale examination of the potential impacts on listed species and their designated critical habitats, and examines how the parameters of the CWF align with the survival and recovery needs of listed species occurring in the action area. The remainder of the project elements not addressed programmatically are addressed as a standard, project-level consultation because they are not subject to future Federal approvals. For framework programmatic actions, an incidental take statement is not required at the program (framework) level for those actions falling within the definition of framework programmatic action (50 CFR 402.02). Therefore, this BiOp contains an ITS for those standard, project-level consultation elements for which incidental take is reasonably certain to occur.

For other project elements lacking the necessary specificity at this time but not requiring future Federal approvals, reinitiation of this consultation may be required when additional information is available. This approach is consistent with the requirement for the action agency to reinitiate consultation under certain circumstances. 50 CFR 402.16 outlines the circumstances that require reinitiation of consultation, which apply to the PA. In addition, this BiOp describes some additional specific conditions under which consultation will need to be reinitiated. These are included by species in the *Effects of the Proposed Action* sections and *Reinitiation-Closing Statement*.

Programmatic portions of the PA will require separate section 7 consultations as part of the subsequent approval. These portions of the PA are not authorized to commence until these separate consultations are completed. This document provides a framework analysis for

subsequent CWF consultations, which includes principles that will be used to guide how CWF is implemented (see the *Guiding Principles for the Framework Programmatic Consultation* section below). The Service anticipates the subsequent consultations will be initiated by either Reclamation or the Corps (depending on the specific project element) and will provide sufficient information as outlined in 50 CFR 402.12(f).

Portions of the PA that require future approvals and are therefore addressed programmatically herein, are: (1) construction of the NDD and associated structures, (2) construction of the HORG, (3) construction of the CCWD settlement agreement facilities, (4) operations of new and existing CVP and SWP water facilities under dual conveyance, (5) future maintenance, (6) future monitoring, and (7) compensatory mitigation associated with construction of the NDD, HORG, and CCWD settlement agreement facilities. Portions of the PA that are addressed as a standard consultation are: (1) construction of the tunnels, (2) expansions and other modifications of CCF, (3) associated infrastructure, (4) geotechnical explorations, (5) compensatory mitigation associated with construction except the NDD, HORG, and CCWD settlement agreement facilities, and (6) specific construction-related conservation measures including preconstruction surveys for listed terrestrial species. As noted above, some of these actions may require reinitiation in the future. We have organized the *Description of the Proposed Action* into programmatic and standard actions for purposes of this consultation (Table 5.0-1).

Table 5.0-1 Components of the mixed programmatic approach.

	Standard consultation w/ITS	Framework programmatic consultation w/no ITS
Pre-construction (geotechnical borings, surveys)	✓	
Construction (Corps Phase 1: access, staging areas, tunnels, CCF)	✓	
Construction (Corps Phase 2: HORG, NDD, CCWD settlement agreement facilities)		✓
Future Project Operations		✓
Monitoring associated with Corps Phase 1 activities	✓	
Monitoring associated with Corps Phase 2 activities		✓
Mitigation/restoration associated with Corps Phase 1 activities	✓	
Mitigation/restoration associated with Corps Phase 2 activities		✓
Maintenance of Corps Phase 1 facilities	✓	
Maintenance of Corps Phase 2 facilities		✓
Adaptive Management related to Corps Phase 1 activities	✓	
Adaptive Management related to Corps Phase 2 activities		✓

6.0 DESCRIPTION OF THE PROPOSED ACTION

The PA includes: (1) construction of the new water conveyance facility including preconstruction geotechnical surveys, (2) new conveyance facility operation in coordination with operation of existing CVP and SWP Delta facilities, (3) maintenance of the existing facilities and newly constructed facilities, (4) Contra Costa Water District (CCWD) Settlement Agreement facilities construction and operation, (5) implementation and maintenance of conservation measures including preconstruction surveys for listed species, and (6) required monitoring of pre- and post-construction and adaptive management activities.

The Service has summarized this description of the PA from the CWF BA and incorporated the BA and appendices by reference. We also incorporated information that resulted from exchanges

between the agencies during early technical assistance and consultation and made minor changes for clarity. The *BiOp Resolution Log* articulates these changes and is included as an appendix to this BiOp. Portions of Chapter 3 in the CWF BA that articulate or summarize existing actions that have been previously analyzed, permitted, or authorized under the Act will not be included in our summary of the PA. However, these items may be discussed in the *Environmental Baseline* section of this BiOp.

DWR is the entity undertaking all construction-related activities including those related to the intakes, the associated tunnels, and their associated infrastructure. The in-water construction activities associated with the intakes, tunnels, and associated infrastructure, as well as the change in SWP Delta operations, requires a combination of Rivers and Harbors Act Section 10, Clean Water Act Section 404, and 33 U.S.C. 408 (408) approvals from the Corps. The Corps has divided the Clean Water Act Section 404, Section 10 of the Rivers and Harbors Act, and 408 permit approvals into two phases. The first phase will involve permit decisions for the construction of tunnels, Intermediate Forebay (IF), CCF modifications, and associated infrastructure. The second phase will involve permit decisions for the NDD and the HORG. DWR and/or its designees will operate and maintain the facilities, and Reclamation will adjust operation of the CVP to utilize the dual conveyance.

Effects resulting from operations, maintenance and monitoring of the new conveyance facilities are addressed at a programmatic-level in this BiOp. Reclamation and the Corps have proposed to prepare future project-specific BAs when subsequent Federal actions occur for these activities. Either Reclamation or the Corps will be the lead Federal action agency for these future consultations (Reclamation 2016a), depending on the triggers and processes for each activity and those agencies' discretionary authority over the action and effects to listed species and critical habitat.

As described in Chapter 1 of the CWF BA, for section 7 consultation under the Act, Reclamation is the lead Federal Agency and Action Agency for coordinated operation of the CVP and SWP ("Operations") and the Corps is the Action Agency for construction. DWR is the applicant. Reclamation has requested consultation on the CWF on behalf of both agencies as the lead Federal Agency.

6.1 Programmatic Actions

Guiding Principles for the Framework Programmatic Consultation

Future CWF actions subject to subsequent Federal decisions or approvals include construction and related actions (including maintenance, mitigation, and monitoring) of the NDD intakes and HORG, and operations of the new CWF facilities. It is anticipated that the construction-related actions subject to future Federal approvals will be consulted upon as part of the Corps' Phase 2 permitting for CWF. Phase 2 permitting will be preceded by the reinitiated consultation on the 2008 Service BiOp and 2009 NMFS BiOp. Agency decisions related to identifying the final

CWF operational criteria will be made in a subsequent consultation, and Reclamation and DWR have committed to analyze and further address species effects from CWF operations at that time.

The following Guiding Principles are proposed by Reclamation and DWR to establish a framework in this consultation under which the future CWF actions will be developed to ensure both that future consultations related to CWF actions build upon the analysis in this document as described in the *Consultation Approach* section above and that the CWF is constructed and operated in a manner that promotes the co-equal goals articulated in California's Delta Reform Act. The principles are intended to promote (1) ecological conditions suitable for all life stages of delta smelt, and (2) water supply reliability. The Guiding Principles are as follows:

1. Improving habitat conditions for rearing juvenile delta smelt, which may include locating the low-salinity zone (LSZ) in suitable areas of the estuary.
2. Operating CVP and SWP water exports in the south Delta to minimize entrainment of migrating and spawning adult delta smelt and larval/young juvenile delta smelt.
3. Promoting increased turbidity in geographical areas and during temporal windows that may be expected to increase the extent and quality of delta smelt habitat through implementation of sediment management plan referenced in the 2017 CWF PA and through actions described in the Delta Smelt Resiliency Strategy.
4. Restoring, creating, or enhancing spawning habitat conditions through use of mitigation commitments made by Reclamation and DWR in the 2017 CWF PA and through actions described in the Delta Smelt Resiliency Strategy.
5. Promoting food production and transport into areas where habitat conditions are suitable for delta smelt.
6. Improving population-level delta smelt habitat conditions through reductions in non-native invasive species.
7. Coordinating operations of the south Delta and NDD water facilities to limit effects to the delta smelt population from cyanobacteria blooms.
8. Implementing all actions in a manner that limits, to the maximum extent practicable, impacts to water supply and provides opportunities to recover water supplies consistent with protection of listed species.

These principles are subject to change over time where the best available scientific information indicates that such change is appropriate. In such event, the agencies will evaluate whether the change triggers the requirement to reinitiate consultation.

Adaptive Management

Reclamation, DWR, the Service, NMFS, CDFW, and the public water agencies have agreed to develop a program of collaborative science, monitoring, and adaptive management in support of CWF (refer to CWF BA *Agreement for Implementation of an Adaptive Management Program for Project Operations, Adaptive Management Program* and *BiOp Resolution Log*). This Agreement and Adaptive Management Program outline a collaborative process for assessing and adapting to effects to listed species stemming from the ongoing operation of the CVP and SWP,

including future implementation and operation of the CWF. Under the adaptive management program, new information developed during the course of implementation is expected to inform operational decisions and conservation tactics. DWR and Reclamation commit to implementing the Adaptive Management Program (AMP), consistent with the *Agreement for Implementation of an Adaptive Management Program for Project Operations*. The AMP includes a cost estimate and DWR and Reclamation commit to implementing the categories of actions described in the cost estimate. However, final determination of the specific actions, implementation plans, and costs associated with implementation of those actions will be determined through the Interagency Implementation and Coordination Group (IICG).

North Delta Diversions

Intakes

The PA includes construction of three intakes (Intake 2, Intake 3, and Intake 5 of the original five proposed in the BDCP) on the east bank of the Sacramento River between Clarksburg and Courtland, in Sacramento County, California. Each intake will divert a maximum of 3,000 cubic feet per second (cfs) of Sacramento River water. Each intake will consist of an intake structure fitted with on-bank fish screens, gravity collector box conduits extending through the levee to convey diverted water to a sedimentation system(consisting of sedimentation basins to capture sand-sized sediment and drying lagoons to dry and consolidate the sediment); a sedimentation afterbay providing the transition from the sedimentation basins to a shaft that will discharge into a tunnel leading to the IF; and an access road, vehicle parking area, electrical service, and fencing. Intake 2 will be located at river mile (RM) 41.1 and will be 1,969 feet (ft) in length, Intake 3 will be located at RM 39.4 and will be 1,497 ft in length, and Intake 5 will be located at RM 36.8 and will be 1,901 ft in length along the Sacramento River's east bank. Text in Section 3.2.2.1 of the CWF BA refers to Appendices 3.A-C for renderings, drawings, and components of the intakes. At the conclusion of construction, the intake facilities will be landscaped, fenced, and provided with security lighting.

Fish Screen Design

Each intake will include fish screens designed to minimize the risk that fish or larvae will be entrained into the intakes or injured by impingement on the fish screens. A general description is provided in Section 3.2.2.2 and references CWF BA Appendix 3.C, *Conceptual Engineering Report, Volume 2*, but final design is not complete. Final design is subject to review and approval by the fish and wildlife agencies (*i.e.,* Service, NMFS, and CDFW). DWR will evaluate screen design using recommendations from the FFTT and has described the process to be subject to extensive collaborative discussions with the fish agencies. Additionally a variety of preconstruction studies are proposed to aid in refinement of the fish screen design and are listed in Table 3.4-17 items 1-8 in the CWF BA, as required prior to final intake design.

Levee Work

Levee modifications will be needed to construct the intakes and must provide continual flood management while construction occurs and after it is finished. The levee modifications are described in CWF BA Appendix 3.B, *Conceptual Engineering Report, Volume 1*, Section 15 *Levees*, and in CWF BA Appendix 3.C, *Conceptual Engineering Report, Volume 2,* Drawings 6, 10 to 17, 19, 44, and 45. Additional information on cofferdam construction (one element of the levee work) appears in CWF BA Appendix 3.B, Section 6.2.1, *General Constructability Considerations*. The Sacramento River levees are Federal Flood Control Project levees under the jurisdiction of the Corps and the Central Valley Flood Protection Board, and specific requirements are applicable to the penetrations of these levees that are needed to move Sacramento River water into the proposed conveyance tunnels. Authorizations for this work have not yet been issued. All construction on these levees will be performed in accordance with conditions and requirements set forth in the Corps permit authorizing the work.

Principal levee modifications necessary for conveyance construction are summarized here. See the referenced text in CWF BA Appendices 3.B and 3.C, *Conceptual Engineering Report, Volumes 1 and 2,* respectively, for detailed descriptions of the work. CWF BA Appendix 3.B, Section 15.2, *Sequence of Construction at the Levee,* includes a table detailing the sequence of construction activities in levee work.

New facilities interfacing with the levee at each intake site will include the following elements:

Levee Widening

Levees near the intakes will be widened on the land-side to increase the crest width, facilitate intake construction, provide a pad for sediment handling, and accommodate a realignment of State Route (SR) 160. Levee widening is done by placing low permeability levee fill material on the land-side of the levee. The material is compacted in lifts and keyed into the existing levee and ground. The levee will be widened by about 250 ft at each intake site. The widened levee sections will allow for construction of the intake cofferdams, associated diaphragm walls, and levee cutoff walls within the existing levee prism while preserving a robust levee section to remain in place during construction.

SR 160 will be impacted by construction activities at each of the three intake sites. During the levee widening, the highway will be permanently relocated from its current alignment along the top of the river levee to a new alignment established on top of the widened levee aligned approximately 220 ft east of the river. The location of the new permanent SR 160 alignment is shown in CWF BA Appendix 3.C, *Conceptual Engineering Report, Volume 2,* Drawings 13, 14, 15 and 16.

On-Bank Intake Structure, Cofferdam, and Cutoff Walls

The intake structure and a portion of the box conduits will be constructed inside a dual sheet pile cofferdam installed within the levee prism on the river-side (CWF BA Appendix 3.C, *Conceptual Engineering Report, Volume 2*, Drawings 15, 16, 17 and 19; construction techniques are described in CWF BA Appendix 3.B, *Conceptual Engineering Report, Volume 1*, Sections 6.2.1, General Constructability Considerations; 15.1, Configuration of Facilities in the Levee; and 15.2, Sequence of Construction at the Levee. See CWF BA Section 3.2.2.5, *Pile Installation for Intake Construction*, for detail on the pile placement required for cofferdam construction). The intake structure foundation will use a combination of ground improvement and steel-cased driven piles or drilled piers. The cofferdams will project from 10 to 35 ft into the river, relative to the final location of the intake screens, dewatering up to 5 acres of channel at each intake site. The river width varies from 475 ft at Intake 3 to 615 ft at Intake 5, so this represents 1.6% to 7.4% of the channel width.

The back wall of each cofferdam along the levee crest will be a deep slurry diaphragm cutoff wall designed for dual duty as a structural component of the cofferdam that will also minimize water seepage through and under the levee; thus the cofferdam sheet piles will become permanent structural components of the intake facility. The diaphragm wall will extend along the levee crest upstream and downstream of the cofferdam and the fill pad on the land-side of the levee, which will allow for a future tie-in with levee seepage cutoffs that are not part of the PA. The other three sides of each cofferdam, including a center divider wall, will be sheet pile walls. The cofferdam will include a permanent, 5-ft-thick tremie concrete seal in the bottom to aid dewatering and construction within the enclosed work area.

In conjunction with the diaphragm wall, a slurry cutoff wall (soil, bentonite, and cement slurry) will be constructed around the perimeter of the construction area for the land-side facilities. This slurry wall will be tied into the diaphragm wall at the levee by short sections of diaphragm wall perpendicular to the levee. The slurry cutoff wall will overlap for approximately 150 ft along the diaphragm wall at the points of tie-in. The slurry wall is intended to help prevent river water from seeping through or under the levee during periods when deep excavations and associated dewatering are required on the land-side. By using the slurry wall in conjunction with the diaphragm wall, the open cut excavation portion of the work on the land-side will be completely surrounded by cutoff walls. These walls will minimize induced seepage from the river through the levee, both at the site and immediately adjacent to the site, and serve as long-term seepage control behind the levee.

Once each cofferdam is completed and the tremie seal has been poured and has cured, the enclosed area will be dewatered and any stranded fish will be rescued in accordance with a fish rescue plan that will be developed by DWR or its contractors and approved by CDFW, NMFS, and the Service. Following full dewatering, areas within the cofferdam will be excavated to the level of design using a clam shell or long-reach backhoe. Then, ground improvements (jet grouting and deep soil mixing) will be made to enable installation of foundation piles that will support the intakes and fish screens.

At the upstream and downstream ends of each intake structure, a sheet pile training wall will transition from the concrete intake structure into the river-side of the levee. Riprap will be placed on the river-side slope upstream and downstream of the training walls to prevent erosion that could result from anomalies in the river created by the structure. Riprap will also be placed along the face of the structure at the river bottom to resist scour.

After intake construction is complete the cofferdammed area will be flooded and underwater divers using torches or plasma cutters will trim the sheet piles at the finished grade/top of structural slab. A portion of the cofferdam will remain in place after intake construction is complete to facilitate dewatering as necessary for maintenance and repairs, as shown in CWF BA Appendix 3.C, *Conceptual Engineering Report, Volume 2,* Drawing 16.

Box Conduits

Large gravity collector box conduits (12 conduits at each intake) will lead from the intake structure through the levee to the land-side facilities. The box conduits will be constructed by open-cut methods after the intake portion of the cofferdam is backfilled. Backfill above the box conduits and reconstruction of the disturbed portion of the levee prism will be accomplished using low-permeability levee material in accordance with Corps specifications.

Pile Installation for Intake Construction

Table 6.1-1 summarizes proposed pile driving at the intake sites, including the type, size, and number of piles required to build the cofferdams and structural reinforcements of the intakes. Table 6.1-1 also shows the number of piles anticipated to be driven per day, the number of impact strikes per pile, and whether piles will be driven in-water or on land. CWF BA Table 3.2-7 specifies 42-inch steel piles for the intake foundations; however, depending on the findings of the geotechnical exploration, it may be feasible to replace some or all of those steel piles with cast-in-drilled-hole (CIDH) foundation piles. The CIDH piles are installed by drilling a shaft, installing rebar, and filling the shaft with concrete. No pile driving is necessary with CIDH methods. If concrete-filled steel piles are required, their installation will involve vibratory or impact pile driving to set hollow steel piles deep into the sediment, so they can then be filled with concrete. CWF BA Table 3.2-7 assumes that all piles will be driven using impact pile driving, but the design intent is to use impact pile driving only for the piles supporting the foundations of the intakes. All other piles (*e.g.,* cofferdams) will be initially driven into the river bottom using vibratory pile driving but may require impact pile driving to reach design depths. Based on experience during construction of the Freeport diversion facility, it is expected that approximately 70% of the length of each pile can be placed using vibratory pile driving, so in an equivalent situation, impact driving would be needed for the other 30%. In-water pile driving will be subject to abatement (*e.g.,* use of a bubble curtain), hydroacoustic monitoring, and compliance with timing limitations as described in CWF BA Appendix 3.F.

Table 6.1-1. Pile driving for intake construction.

Feature	On-land or In-water	Pile Type/ Sizes	Total Piles	Number of Pile Drivers in Concurrent Use	Piles/ Day	Strikes/ Pile	Strikes/ Day
Intake Cofferdam – Intakes 2, 3, and 5	In-water	Sheet pile	2,500	4	60	210	12,600
Intake Structure Foundation – Intake 2	In-water	42-inch diameter steel	1,120	4	60	1,500	90,000
Intake Structure Foundation – Intake 3	In-water	42-inch diameter steel	850	4	60	1,500	90,000
Intake Structure Foundation – Intake 5	In-water	42-inch diameter steel	1,120	4	60	1,500	90,000
SR-160 Bridge (Realignment) at Intake	On-land	42-inch diameter steel	150	2	30	1,200	36,000
Control Structure at Intake	On-land	42-inch diameter steel	650	4	60	1,200	72,000
Pumping Plant and Concrete Sedimentation Basins at Intake	On-land	42-inch diameter steel	1,650	4	60	1,200	72,000

Sheet pile placement for cofferdam installation will be performed by a barge-mounted crane equipped with vibratory and impact pile driving rigs. Foundation pile placement within the cofferdammed area may be done before or after the cofferdammed area is dewatered. If it is done after the area is dewatered and the site is dry, a crane equipped with pile driving rig will be used within the cofferdam. If done before the cofferdam is dewatered, pile driving will be performed by a barge-mounted crane positioned outside of the cofferdam or a crane mounted on a deck on top of the cofferdam.

Construction Overview for North Delta Diversions

The NDD construction timeline is presented in CWF BA Appendix 3.D, *Construction Schedule for the Proposed Action*. The schedule is complex, with work simultaneously occurring at all major facilities for a period of years. During construction, the sequence of activities and duration of each schedule element will depend on the contractor's available means and methods, definition and variation of the design, departure from expected conditions, and perhaps other variable factors.

Each intake has its own construction duration projected to take approximately 4 to 5 years. Early phase tasks to facilitate construction will include mobilization, site work, and establishing concrete batch plants, pug mills, and cement storage areas. During mobilization the contractors will bring materials and equipment to construction sites, set up work areas, locate offices, staging

and laydown areas, and secure temporary electrical power. Staging, storage, and construction zone preparation areas for each intake site will cover approximately 5 to 10 acres. Barges, which will be used as construction platforms for drilling rigs, cranes, etc., will be present throughout the construction period at each intake facility.

Site work consists of clearing and grubbing vegetation, constructing site work pads, building construction access roads, and building barge access sites. Before site work commences, the contractor will implement erosion and sediment controls in accordance with the Stormwater Pollution Prevention Plan (SWPPP). Specific plans for site clearing and grubbing and site access to stockpile locations have not yet been developed, but will be subject to erosion and dust control measures as specified in the SWPPP and other permit authorizations.

Although DWR plans to use existing roads to the greatest extent possible, some new roads will be constructed to expedite construction and to minimize impacts to residents, commuters and the environment. Access roads and environmental controls will be maintained consistent with best management practices (BMPs) and other requirements of the SWPPP and permit documents.

Substantial amounts of engineered fill will be placed landward of the levee, amounting to approximately 2 million cubic yards at each intake site. This fill material will be used primarily to widen the levee, build construction pads for the fills, and other land work needed to ensure that the permanent facilities are at an elevation above the design flood stage (*i.e.,* a 200-year flood with additional allowance for sea level rise). The required engineered fill material will preferably be sourced onsite from locations within the permanent impact footprint, for instance from excavations to construct the sedimentation basins, but may also need to be sourced from off-site locations.

Head of Old River Gate

In the CWF BA, DWR recognizes that design of the HORG is in the early stages. As such, DWR proposes to convene a CCF Technical Team with representatives from DWR, Reclamation, NMFS, CDFW, and the Service upon initiation of formal consultation for the PA. The team will meet periodically until DWR completes final design for the proposed gate (expected to be at least two years). The general concepts and construction components are summarized below and reference the CWF BA where appropriate.

An operable gate will be constructed at the Head of Old River (HOR) to replace the existing barrier at this channel junction. The existing seasonal rock barrier will remain in use until the HORG is complete. The gate will be located at the divergence of the HOR and the San Joaquin River, within the confines of the existing Old River channel, with no levee relocation, as shown in CWF BA Appendix 3.A, *Map Book for the Proposed Action*, Sheet 16. The proposed location is approximately 300 ft west of the temporary rock barrier that is annually installed and removed under current conditions. Preliminary design of the HORG specifies that it will be 210 ft long and 30 ft wide, with a top elevation of +15 ft (CWF BA Appendix 3.C, *Conceptual Engineering*

Report, Volume 2, Sheets 95 and 96). Design and construction are further detailed in CWF BA Appendix 3.B, *Conceptual Engineering Report, Volume 1*, Section 17, *Operable Barrier*.

The proposed HORG will include seven bottom-hinged gates, totaling approximately 125 ft in length. Other components include a fish passage structure, a boat lock, a control building, a boat lock operator's building, and a communications antenna. Appurtenant components include floating and pile-supported warning signs, water level recorders, and navigation lights. The facility will also have a permanent storage area (180 by 60 ft) for equipment and operator parking. Fencing and gates will control access to the structure. A propane tank will supply emergency power.

The boat lock will be 20 ft wide and 70 ft long. The final design of the associated fish passage structure will be established with input from NMFS and the Service, but is proposed to be 40 ft long and 10 ft wide, and constructed with reinforced concrete. Stop logs will be used to close the fish passage structure when it is not in use to protect it from damage. When the HORG is partially closed, flow will pass through a series of baffles in the fish passage structure. The fish passage structure is designed to maintain a 1-ft-maximum head differential across each set of baffles. The historical maximum head differential across the rock barrier is 4 ft, so it is anticipated that four sets of baffles will be required. The vertical slot fish passage structure will be entirely self-regulating and will operate without mechanical adjustments to maintain an equal head drop through each set of baffles regardless of varying upstream and downstream water surface elevations.

Construction

The HORG will be constructed using cofferdam construction techniques, which will create a dewatered construction area for ease of access and egress. To ensure the stability of the Old River levees, sheet pile retaining walls will be installed in the levees where the operable barrier connects to them. Construction will occur in two phases. The first phase will include construction of half of the operable barrier, masonry control building, operator's building, and boat lock. The second phase will include construction of the second half of the operable barrier, the equipment storage area, and the remaining fixtures, including the communications antenna and fish passage structure. The construction period is estimated to be up to 32 months, with a maximum construction crew of 80 people. A temporary work area of up to 15 acres will be sited in the vicinity of the barrier for such uses as storage of materials, fabrication of concrete forms or gate panels, placing of stockpiles, office trailers, shops, and the maintenance of construction equipment. The operable barrier construction site, including the temporary work area, has for many years been used for seasonal construction and removal of the temporary rock barrier, and all proposed work will occur within the area that is currently seasonally disturbed for temporary rock barrier construction (and deconstruction). Site access roads and staging areas used in the past for rock barrier installation and removal will be used for construction, staging, and other construction support facilities.

All in-water work, including the construction of cofferdams, sheet pile walls and pile foundations, and riprapping, will occur during the proposed in-water work windows to minimize effects on fish. Bubble/sound barrier (with acoustic monitoring to verify reduction in sound field) will be used when impact hammers are used. All land-based construction will take place from a barge or from the levee crown and will occur throughout the year.

The construction of the cofferdam and the foundation for the HORG will require in-water pile driving. The installation of the cofferdams will require approximately 550 sheet piles (275 per season). Approximately 15 piles, a maximum of 50 ft long and driven to a depth of 13.5 to 15 ft, will be set per day with an estimated 210 strikes per pile over a period of approximately 18 days per season. Sheet piles will be installed starting with a vibratory hammer, which may then switch to an impact hammer if the target depth cannot be achieved using the vibratory hammer. The foundation for the operable barrier will require 100 14-inch steel pipe or H-piles (50 per season) which will be set with 1 pile driver located on site. Approximately 15 piles, a maximum of 50 ft long and driven to a depth of 13.5 to 15 ft, will be set per day with an estimated 1,050 strikes per pile over a period of approximately 3 days per season. Foundation pile driving may be done in the dry or in the wet. It is possible that CIDH concrete foundation piles will be used, in which case pile driving of foundation piles will not be required, but that determination awaits results of geotechnical analysis and further design work.

The first construction phase involves installing a cofferdam in half of the channel and then dewatering the cordoned-off area. The cofferdam will remain in the water until the completion of half of the gate. The cofferdam will then be flooded, and removed or cut off at the required depth. Then, a new cofferdam will be installed in the other half of the channel. In the second phase, the gate will be constructed using the same methods; again when finished, the cofferdam will either be removed or cut off at the foundation. Cofferdam construction will in both phases begin in August and last approximately 18 days. Construction has been designed so that the rock barrier used at this site can continue to be installed and removed until the permanent gates are fully operable.

Dredging

Dredging to prepare the channel for gate construction will occur along 500 ft of the Old River channel, from 150 ft upstream to 350 ft downstream of the proposed barrier. A total of up to 1,500 cubic yards of material will be dredged. Dredging will last approximately 15 days, and like other aspects of HORG construction, will be performed during the in-water work window. Dredging may use either a hydraulic or a sealed clamshell dredge, in either case the dredge will be operated from a barge in the channel. Dredging for the HORG is proposed to deviate from the procedure described in AMM 6 in CWF BA Appendix 3.F, *General Avoidance and Minimization Measures,* in one respect. If local landowners are interested and appropriate review authorities determine the plan to be acceptable, then DWR proposes to spread dredged sediment onto adjacent agricultural fields in a layer approximately 1-foot thick. If this plan is not acceptable and DWR is required to use an existing dredged material disposal site, the site

currently used for dredged material disposal for the temporary rock barrier placement and removal will be used.

Dual Conveyance Operations of the CVP and SWP

This BiOp analyzes the BAs operational scenario at a programmatic-level and identifies potential effects to delta smelt and its designated critical habitat from the operational scenario described. Our effects analysis considers the framework provided by the Guiding Principles as described above and in the PA and includes the effects of the Guiding Principles in the analysis.

Implementation

Implementation of the PA will include operations of both new and existing water conveyance facilities once the new NDD facilities are completed and become operational. Most existing facilities will continue to be operated consistent with existing regulatory authorizations, including the Service (2008) and NMFS (2009) BiOps or subsequent BiOps.
See CWF BA Table 3.1-1 for a complete summary of facilities and actions included in the PA. The PA also includes operational criteria for Delta outflow during the spring (March through May; hereafter termed "spring outflow") and minimum flow criteria at Rio Vista for the months of January through August that will apply when the proposed NDD becomes operational. The NDD and the HORG are new facilities for the SWP and will be operated consistent with the PA criteria presented in CWF BA for these facilities and any new flow criteria stemming from the Water Quality Control Plan (WQCP) update or long-term operations BiOps.

Criteria

The CWF BA attempts to describe the temporal scale at which some of the operational criteria will be implemented (*e.g.,* north Delta bypass flow requirements and Old and Middle river [OMR] requirements). The CalSim II modeling cannot perfectly represent all of the operational decisions associated with real-time operations (RTO) of the PA (see Table 6.1-2). A detailed operations plan will be developed by Reclamation and DWR in coordination with CDFW, NMFS and the Service prior to the new facilities becoming operational, which will detail implementation of the criteria presented in Table 6.1-2 and 6.1-3.

Additionally DWR collaborated with CDFW to develop spring outflow criteria for longfin smelt. As described in Table 6.1-3, protective outflows from March 1 through May 31 every year will be determined by the use of a lookup table derived from a linear relationship between the 50% exceedance forecast for the current month's 8RI and recent historic Delta outflow (1980 – 2016).

RTO of the NDD are intended to allow for the project objective of water diversion while also providing for the protection of migrating and rearing salmonids. RTO will be a key component of NDD operations, and will likely govern operations for the majority of the December through June salmonid migration period. Under RTO, the NDD would be operated within the range of pulse protection, and Levels 1, 2, and 3, depending on risk to fish and with consideration for

other factors such as water supply and other Delta conditions, and by implementing pulse protection periods when primary juvenile winter-run and spring-run Chinook salmon migration is occurring. Post-pulse bypass flow operations may remain at Level 1 pumping depending on fish presence, abundance, and movement in the north Delta; however, the exact levels will be determined through initial operating studies evaluating the level of protection provided at various levels of pumping. The specific criteria for transitioning between and among pulse protection and post-pulse bypass flow operations will be based on real-time fish monitoring and hydrologic/ behavioral cues upstream of and in the Delta that will be studied as part of the PA's AMP (CWF BA Section 3.4.6). Based on the outcome of the studies listed in Section 3.4.6, information about appropriate triggers, off-ramps, and other RTO management of NDD operations will be integrated into the operations of the PA. RTO will be used to support the successful migration of salmonids past the NDD and through the Delta, in combination with other operational components of the PA.

The following operational framework serves as an example that is based on the recommended NDD RTO process (Marcinkevage and Kundargi 2016). A 5-agency technical team co-chaired by NMFS and CDFW will incorporate results from ongoing monitoring and studies to revise specific fish triggers and may further refine the RTO process based on the amount of time it takes to make the RTO change in pumping rates and a science plan developed through the collaborative science process and finalized through the adaptive management process prior to commencement of actual operations of the NDD.

Table 6.1-2. New and existing water operations flow criteria and relationship to assumptions in CalSim II modeling.

Parameter	Criteria	Summary of CalSim II Modeling Assumptions
New Criteria Included in the PA		
North Delta bypass flows[1]	• Bypass Flow Criteria (specifies bypass flow required to remain downstream of the NDD): • October, November: Minimum flow of 7,000 cfs required in river after diverting at the NDD. • December through June: Post-pulse bypass flow operations will not exceed Level 1 pumping unless specific criteria have been met to increase to Level 2 or Level 3. If those criteria are met, operations can proceed as defined in CWF BA Table 3.3-2. The specific criteria for	• Initial Pulse Protection: ◦ Low-level pumping of up to 6% of total Sacramento River flow such that bypass flow never falls below 5,000 cfs. No more than 300 cfs can be diverted at any one intake. ◦ If the initial pulse begins and ends before December 1, criteria for the appropriate month (October–November) go into effect after the pulse

[1] Sacramento River flow upstream of the intakes to be measured flow at Freeport. Bypass flow is the Sacramento River flow quantified downstream of the Intake 5. Sub-daily NDD operations will maintain fish screen approach and sweeping velocity criteria.

	transitioning between and among pulse protection, Level 1, Level 2, and/or Level 3 operations, will be developed and based on real-time fish monitoring and hydrologic/ behavioral cues upstream of and in the Delta. During operations, adjustments are expected to be made to improve water supply and/or migratory conditions for fish by making real-time adjustments to the pumping levels at the NDD. These adjustments will be managed under RTO as described below. • July, August, September: Minimum flow of 5,000 cfs required in river after diverting at the NDD. • Pulse Protection: • Low-level pumping of up to 6% of total Sacramento River flow at Freeport such that bypass flow never falls below 5,000 cfs. No more than 300 cfs can be diverted at any one intake. • Low level pumping maintained during the pulse protection period. • Pulse is determined based on real-time monitoring of juvenile fish movement as described in CWF BA Section 3.3.3.1 *North Delta Diversion*. • If the initial pulse begins and ends before Dec 1, the bypass flow criteria for the month (Oct-Nov) when the pulse occurred would take effect. On Dec 1, the Level 1 rules defined below apply unless a second pulse occurs. Post-pulse Criteria (specifies bypass flow required to remain downstream of the NDD): • December through June: once the pulse protection ends, post-pulse bypass flow operations will not exceed Level 1 pumping unless specific criteria have been met to increase to Level 2 or Level 3. If those criteria are met, operations can proceed as defined in CWF BA Table 3.3-2. Allowable diversion will be greater of the low-level pumping or the diversion allowed by the post-pulse bypass flow rules in CWF BA Table 3.3-2. The specific criteria for transitioning between and among pulse protection, Level 1, Level 2, and/or Level 3 operations, will be developed and based on real-time fish monitoring and hydrologic/behavioral cues upstream of and in the Delta as discussed in CWF BA Section 3.3.3.1, *North Delta Diversion*. During operations, adjustments to the default allowable diversion level specified in CWF BA Table 3.3-2 are expected to be made to improve water supply and/or migratory	until December 1. On December 1, the Level 1 rules defined in CWF BA Table 3.3-2 apply until a second pulse, as defined in CWF BA Table 3.3-3 occurs. The second pulse will have the same protective operation as the first pulse.

	conditions for fish by making real-time adjustments to the diversion levels at the NDD. These adjustments are expected to fall within the operational bounds analyzed for the CWF BA and will be managed under RTO.	
South Delta operations[2,3]	• October, November: To be determined based on real time operations and protection of the D-1641 San Joaquin River 2-week pulse • December: OMR flows will not be more negative than an average of -5,000 cfs when the Sacramento River at Wilkins Slough pulse (same as NDD bypass flow pulse defined in CWF BA Table 3.3-2) triggers[4], and no more negative than an average of -2,000 cfs when the 2008 Service BiOp action 1 triggers. No OMR flow restriction prior to the Sacramento River pulse or 2008 Service BiOp action 1 triggers. • January, February: OMR flows will not be more negative than a 3-day average of 0 cfs during wet years, −3,500 cfs during above-normal years, or −4,000 cfs during below-normal to critical years, except −5,000 in January of dry and critical years. • March[5]: OMR flows will not be more negative than a 3-day average of 0 cfs during wet or above- normal years or −3,500 cfs during below-normal and dry year and -3,000 cfs	• December: −5,000 cfs only when the Sacramento River pulse based on the Wilkins Slough flow (same as the pulse for the NDD) occurs. If the 2008 Service BiOp Action 1 is triggered,−2,000 cfs requirement for 14 days is assumed. Remaining December days were assumed to have an allowable OMR of -8,000 cfs to compute a composite monthly allowable OMR level. • April, May: OMR requirement for the Vernalis flows between 5,000 cfs and 30,000 cfs were determined by linear interpolation. For example, when Vernalis flow is between 5,000 cfs and 6,000 cfs, OMR requirement is determined by linearly interpolating between −2,000 cfs and +1,000 cfs.

[2] The criteria do not fully reflect the complexities of CVP and SWP operations, dynamic hydrology, or spatial and temporal variation in the distribution of aquatic species. As a result, the criteria will be achieved by operating within an initial range of real time operational criteria from January through March and in June. This initial range, including operational triggers, will be determined through future discussion, including a starting point of -1,250 to -5,000 cfs based on a 14-day running average, and will be informed by the AMP, including real time monitoring. Further, the 3-day averaging period may be modified through future discussion. Modifications to the 3-day average period and the range of operating criteria may be needed, in part, because: (1) the WY type is forecasted in February but not finalized until May, and (2) 0 cfs, or positive, OMR in wet and above normal years may be attained coincident with unimpaired flows.

[3] OMR measured through the currently proposed index-method (Hutton 2008) with a 14-day averaging period consistent with the current operations (Reclamation 2014).

[4] December Sacramento River pulse determined by flow increases at Wilkins Slough of greater than 45% within 5-day period and exceeding 12,000 cfs at the end of 5-day period, and real-time monitoring of juvenile fish movement. Reclamation and DWR will require lead time. Preliminary discussions with engineers indicates ramping down can begin within an hour of no less than 3 days to change operations in response to the pulse trigger and full ramp down could be complete within approximately 12 hours. The Wilkins Slough trigger will be reviewed through future discussion, which will be informed by the AMP, including real time monitoring.

[5] WY type as described in the above footnote.

	during critical years. • April, May[6]: Allowable OMR flows depend on gaged flow measured at Vernalis, and will be determined by a linear relationship. If Vernalis flow is below 5,000 cfs, OMR flows will not be more negative than -2000 cfs. If Vernalis is 6,000 cfs, OMR flows will not be less than +1000 cfs. If Vernalis is 10,000 cfs, OMR flows will not be less than +2,000 cfs. If Vernalis is 15,000 cfs, OMR flows will not be less than +3,000 cfs. If Vernalis is at or exceeds 30,000 cfs, OMR flows will not be less than 6,000 cfs. • June: Similar to April and May, allowable flows depend on gaged flow measured at Vernalis (except without interpolation). If Vernalis is less than 3,500 cfs, OMR flows will not be more negative than −3,500 cfs. If Vernalis exceeds 3,500 cfs up to 10,000 cfs, OMR flows will not be less than 0 cfs. If Vernalis exceeds 10,000 cfs up to 15,000 cfs, OMR flows will not be less than +1,000 cfs. If Vernalis exceeds 15,000 cfs, OMR flows will not be less than +2,000 cfs. • July, August, September: No OMR flow constraints[7]. • OMR criteria under 2008 Service and 2009 NMFS BiOps or the above, whichever results in more positive, or less negative OMR flows, will be applicable[8].	• January–March and June–September: Same as the criteria • New OMR criteria modeled as monthly average values.
HORG operations	• October 1- November 30: RTO management – with the current expectation being that the HORG will be operated to protect the D-1641 pulse flow. • January-March 31, and June 1-15: RTO will determine exact operations to protect salmon fry when migrating. During this migration, operation will be to close the gate subject to RTO for purposes of water quality, stage, and flood control considerations. • April-May: Initial operating criterion will be to close the gate 100% of the time subject to RTO	• Assumed 50% open from January 1 to June 15 and during days in October prior to the D-1641 San Joaquin River pulse. Closed during the pulse. 100% open in the remaining months.

[6] When OMR target is based on Vernalis flow, will be a function of 5-day average measured flow.
[7] The PA operations include a preference for south Delta pumping in July through September months to provide limited flushing flows to manage water quality in the south Delta.
[8] Change in CVP and SWP pumping from the south Delta will occur to comply with OMR targets and will be achieved to the extent exports can control the flow. The OMR targets would not be achieved through releases from CVP and SWP reservoirs. The combined CVP and SWP export rates from the proposed NDD and the existing south Delta intakes will not be required to drop below 1,500 cfs to provide water supply for health and safety needs, critical refuge supplies, and obligation to senior water rights holders.

	for purposes of water quality, stage, and flood control considerations (CWF BA Section 3.3.3, *Real-Time Operational Decision-Making Process*). Reclamation, DWR, NMFS, Service, and CDFW will actively explore the implementation of reliable juvenile salmonid tracking technology that may enable shifting to a more flexible real time operating criterion based on the presence/absence of listed fishes. • June 16 to September 30, December: Operable gates will be open.	
Spring Outflow	March, April, May: Initial operations will maintain the March–May delta outflows that maintain longfin smelt habitat quality and quantity at levels consistent with recent conditions (1980-2016).[9]	• 2011 NMFS RPA for San Joaquin River I/E ratio constraint is the primary driver for the Apr-May Delta outflow under the NAA, this criterion was used to constrain Apr-May total Delta exports under the PA to meet Mar-May Delta outflow targets.
Rio Vista minimum flow standard[10]	• September through December: flows per D-1641	• Same as PA criteria
Key Existing Delta Criteria Included in Modeling[11]		
Fall Outflow	• No change. September, October, November: implement the Service 2008 BO Fall X2 requirements in wet and above normal WY types.	• September, October, November: implement the 2008 Service BiOp "Action 4: Estuarine Habitat During Fall" (Fall X2) requirements (Service 2008).
Winter and summer outflow	• No change. Flow constraints established under D-1641 will be followed if not superseded by criteria listed above.	• State Water Resources Control 's (SWRCB) D-1641 Delta outflow and February – June X2 criteria.
Delta Cross Channel Gates	• Operating criteria as required by 2009 NMFS BiOp Action IV.1 and D-1641, and Delta Cross Channel (DCC) closure for downstream flood control will be based on Sacramento River flow at Freeport, upstream of the NDD facilities.	• DCC gates are closed for a certain number of days during October 1 through December 14 based on the Wilkins Slough flow, and the gates may be opened if the D-1641 Rock Slough salinity standard is violated because of the gate

[9] See targets in spring outflow table below: *Spring Outflow Criteria, Upon initiation of the Test Period and throughout the CDFW permit term, average Delta outflow for Longfin Smelt based on the 50% exceedance forecast for the current month's Early Long-Term (ELT) 8 River Index (8RI).*

[10] Rio Vista minimum monthly average flow in cfs (7-day average flow not be less than 1,000 below monthly minimum), consistent with the SWRCB D-1641.

[11] All the CalSim II modeling assumptions are described in CWF BA Appendix 5.A, *CALSIM Methods and Results*.